All contributions to be sent to the Editor, 57 Church Street, Old Isleworth, Middlesex. (Telephone, Hounslow 0391.)

British Journal of Anæsthesia

Vol. XXI, No. 2 July 1948

EDITORIAL

RECENT advances in our specialty have gone far to raise its professional status but have at the same time complicated the business of teaching undergraduates. Dr. Challis, in his presidential address to the Anæsthetic Section of the Royal Society of Medicine, stresses the need for co-operation between those engaged in teaching, in order to determine the principles on which it should be based. Some of the new members of the Editorial Board are Heads of University Departments of Anæsthesia and comment is made as follows:

Dr. R. P. Harbord writes:

The main problems are, what to teach, when to teach it, and how much time should be devoted in the medical course to anæsthesia? Most, but by no means all anæsthetics administered at a teaching hospital are given by specialists. Anæsthetics are, however, still given in the country hospitals and patient's own homes by ordinary doctors. It is probably true that cases dealt with by the general practitioner mainly include operations of a minor character, although some of the emergencies demand considerable anæsthetic care.

A pre-clinical introduction to the subject in the form of a short informal lecture course, demonstrations, practical opportunities for individual experience in open drop ether (as the basic form of anæsthesia), and also experiences and demonstrations of anæsthetics for short operations, i.e., ethyl chloride, nitrous oxide, and pentothal are desirable. At the time when

experience is begun a short course of lectures dealing mainly with the practical points should be helpful. During the final year some time should be devoted to gaining anæsthetic experience in special subjects, i.e., obstetrics, dentistry, and general surgery for emergencies.

The amount of time allocated to anæsthesia in the medical curriculum should be a matter for each University to decide, but the General Medical Council should be approached to specify a minimum period. All that is required up to date is, "A course of theoretical and practical instruction in the administration of Anæsthetics".

Dr. T. Cecil Gray writes:

It would appear that there are two extreme schools of thought concerning the need for undergraduate teaching of anæsthesia. On the one hand it is maintained that anæsthesia in its modern guise must cease to be an undergraduate study. Owing to the complexity of its methods and the large scope of its basic sciences it must in the future be entirely the realm of the specialist. On the other hand there are those who would teach undergraduates everything from open ether to the administration of curare. Clearly the ideal lies between these two extremes, and the aim, as Dr. Challis points out, "must be to produce general practitioners who are capable of administering reasonable anæsthesia and who realize their own limitations".

In this matter the newly constituted Faculty of Anæsthetists will be of enormous value and it should be one of the first concerns of the Board of that Faculty to investigate fully the numerous problems involved. Through this Academic body some uniformity may be achieved in the methods taught and the time spent on the subject in the curriculum of the various medical schools.

Dr. Ronald Woolmer writes:

Anæsthetists at teaching hospitals have often to ask themselves the question: "How far am I justified in subjecting this

MAYO CLINIC LIBRARY

patient to a method of anæsthesia which is not the best for him, in order to teach the students those simple techniques which may be useful to some of them in general practice?"

In some cases, such as that of the fit young man with a hernia, there is clearly ample justification: in others, such as that of the elderly cacheotic patient with a gastric carcinoma, there is none, and the presence of the student is for practical purposes a waste of time. Attempts have been made at one or two teaching hospitals to separate cases of the first sort from the others, and to put them on operating lists arranged specially for the benefit of the students. The administrative difficulties in the way of this scheme, however, are formidable.

Anæsthetists would feel better justified in suiting the anæsthetic to the student rather than to the patient if they were sure that the student was destined for a general practice in which he would be required to give simple anæsthetics. Better still, if the student would return after qualification and say: "I have gone into a general practice of such and such a type. Please give me practical instruction in the methods appropriate to it". This, alas, is seldom possible for economic reasons, but the proposed "intern year" to be spent in hospital before registration may provide an opportunity for instruction for those intending to enter general practice.

It is clear that in the future fewer and fewer anæsthetics will be given by general practitioners, but it is equally clear that many years must elapse before there will be a specialist available for every case. Meanwhile, the best compromise must be made between the interests of the patient and the needs of the student. This resolves itself largely into a matter of organization. No simple anæsthetics should be wasted as teaching material. Gases in the Dental Department, short anæsthetics in Casualty and the fracture clinic, and anæsthetics in the Obstetric Department should all be made use of. In addition, students doing anæsthetics should take it in turns to be in the hospital at night in order to gain experience of anæsthesia for emergency surgery.

THE TEACHING OF MEDICAL STUDENTS—ANÆSTHESIA*

By Major J. H. T. Challis, D.A.
Anæsthetist to the London Hospital

I MUST own the selection of this subject is entirely selfish on my part as I am exceedingly interested in teaching and secondly I wish to obtain your views on many knotty problems. In the preparation of the paper I have consulted all the available literature, which consisted of three short articles, mainly irrelevant.

It has been obvious to all of us for many years that the teaching has been inadequate and highly unsatisfactory for the average general practitioner, due to the enormous growth of the number of drugs employed and the varying methods of their use.

During the last year this great deficiency has been realized by many teaching hospitals and they have appointed, or are in the process of appointing, Directors of Anæsthetic Teaching.

This is our great opportunity to get together and at any rate agree on the basic principles we should adopt in teaching the future generation; in this we need the help of the younger anæsthetists who can tell us where we have failed in the past and help us to plan for the future, seeing that we do not fall into ruts, which is so common. Therefore, I hope that at the end of this paper you will speak freely on the many controversial points.

Before it is possible to produce any curriculum it is essential to have some ideas of:

1. Number of students.
2. Time at their disposal.
3. Material available for teaching.
4. Constitution of the teaching staff.

* Presidential address to the Section of Anæsthetics Royal Society of Medicine, 1947

I will answer these queries for one hospital only, hoping it will prove to be a fair average for most teaching schools.

1. Number of students—Six to eight.

2. Time at their disposal—one month, students living in the immediate vicinity of the hospital, in fact in the hospital hostel, so that they are available for emergency as well as normal routine work. They are called by 'phone even during the night, working on a rota so that 2 are always available. I agree that even with these arrangements the time allowed (one month) is inadequate but in view of the already overcrowded curriculum it is unlikely we can hope for any improvement for some years to come.

3. The material is the average found at all teaching hospitals.

4. Teaching staff consists of:

1 Director, part time.
4 Honorary Anæsthetists, part time.
1 Anæsthetic Registrar, full time.
2 Resident Anæsthetists; the senior having the D.A.

In order to limit the course students are not taught on any of the major cold surgery cases and attend only as spectators or to take blood-pressures. Under this heading are included:

1. Cranial and spinal cases.
2. Partial gastrectomies and abdomino-perineal resections.
3. Thyroidectomies.
4. Laryngectomies.
5. Chest surgery, etc.

The work on these cases is reserved for post-graduates who show aptitude towards anæsthesia. Whether you think this is right or not I shall be interested to hear.

The actual methods of teaching are:

Primarily, after being shown once, the student is encouraged to do the work himself. After the administration of pentothal free speech in the anæsthetic room is permissible and the teacher stands by and corrects faults. This is somewhat nerve-wracking for the teacher but unless students actually handle

things themselves they gain little. Everything is sacrificed for practical work but when this is not available lectures are given daily, mainly by the Director and Honorary Staff, on:

1. Obstetric Analgesia—Gas/Air and Trilene/Air;

2. Signs of Anæsthesia—Guedel with special emphasis on the really useful and commonly used signs.

3. Pre-operative Preparation—Premedication drugs and their indications, dosages, etc.—(Diabetic).

4. Post-operative Treatment—Sedation, transfusion, feeding, and breathing education.

5. Gas and Oxygen—General principles, limitations and applications.

6. Gas and Oxygen—Use in "bad risks", children, obstetrics, dental.

7. Anoxæmia—Emphasis on its dangers; methods of avoiding its occurence even in sub-clinical amounts—its relation to nitrous oxide anæsthesia.

8. Ether—Indications, methods available, contra-indications, etc.

9. Pentothal—Indications, methods available, contra-indications, etc.

10. Chloroform, Trilene and Ethyl Chloride—Indications, methods available, contra-indications, etc.

11. Physics of Anæsthesia—Very elementary treatment of gas laws, vaporization, flowmeters, temperatures.

12. Anatomy of Anæsthesia—Larynx, respiratory tract, nose and throat.

13. Physiology of Anæsthesia—Metabolism and respiration, oxygen and CO_2 carriage, liver detoxication and excretion.

14. Complications of Anæsthesia—"Snags" arising during anæsthesia—post-op complications ("chest" etc.)

15. Youth and Old Age—Anæsthesia and its modification in children and old people—"bad risks" generally.

Four to six films are shown to each group of students.

Maternity analgesia and anæsthetics are taught whilst the students are doing their gynæcological and maternity work so that this does not cut into their month's course of anæsthesia but usually follows it.

The aim has been to endeavour to produce general practitioners who are capable of administering reasonable anæsthesia in cases where elaborate and highly specialized techniques are not required, and of realizing their own limitations. We have, therefore, concentrated teaching on those types of cases which are at present the province of the G.P. and likely to remain so.

First, dental cases—too often do we hear how dissatisfied are the dentists who have to depend for their anæsthesia on the patient's own doctor. Also it is not unknown for us to have to reassure patients that they will not regain consciousness until the operation is over; the origin of this fear can usually be traced to the dental chair.

For social reasons—that is the large number of cases to be dealt with in a short time and the fact that the patients must leave the department under their own steam—the choice of anæsthesia is limited practically to the use of gas and oxygen. The apparatus in nearly all hospitals and dental surgeries is standardized to the Walton machines, therefore few difficulties arise in teaching except to get sufficient time. Under the scheme outlined at the beginning, it has been found possible for each student to administer approximately 40 dental gases during his month's course, which is certainly an improvement on the pre-war days.

Maternity analgesia and anæsthesia—granted that in years to come every mother will perhaps be delivered in an institution where every known, and as yet unknown, anæsthesia will be laid on at the bed-side, I do not think that these possibilities should deter us at present. We must prepare students to give analgesia. So often in the past have enthusiastic doctors rushed off and bought analgesic machines. They receive instruction in the mechanism over the counter and depart home the proud possessors of what they imagine will be the end of their own and

their patients maternity troubles, but not having any knowledge of the essential technique of its use they fail to get results and soon abandon it. This sort of thing we well know is due to lack of instruction and demonstration. The nursing staff have lectures and demonstrations and practical experience before being allowed the free use of the apparatus. Are doctors so superior that instruction is unnecessary? I think not. Therefore, if you agree, we must add Gas and Air analgesia to our list of essential subjects.

Trilene by means of one of the various inhalers is certainly making a name for itself as a safe, portable, analgesic. It is even lauded by some of the most conservative maternity ward sisters, which is almost more important than being approved by the Central Midwives Board. Therefore, I feel it will not be long before it is in common use and we cannot afford to omit it from our list.

Chloroform, in spite of the introduction of Gas, Air and Trilene, is still likely to hold the prime place in all difficult obstetric cases delivered outside an equipped institution. For pleasantness, portability, cheapness and efficiency it has so far not been beaten and general practitioners for some years to come will continue to use it, irrespective of how we may try to impress them, rightly or wrongly, with its dangers. Another drug added to our already growing list.

The Boyle's machine is always available and much used in institutional maternity work, therefore, in maternity cases it seems to me the bare minimum a student should be taught is:

Gas and Air Analgesia;
Trilene Analgesia and perhaps Anæsthesia;
Chloroform;
Gas and Oxygen with a Boyles machine, supplemented with a little drop of what you fancy!—Trilene, Chloroform or Ether.

Anæsthesia in minor surgery.

Firstly, what types of cases are we visualizing, and secondly,

what are the conditions under which the doctor is working. The type of cases would, broadly speaking, be:

Abscess for opening,
Primary suturing of injuries,
Setting fractures,
Circumcisions, etc.

If they can be admitted to an institution the anæsthetic teaching problem is easy.

1. Sufficient time is allowed for stomachs to empty.
2. Premedication is timed and given.
3. The appropriate anæsthetic is administered.
4. They return to their beds to recover and are not discharged until fit.

Now let us take the same type of surgical conditions but with different surroundings:

The country doctor with or without a partner, miles from the nearest hospital, called to the local farmer with a dirty cut requiring excision of edges and suturing. What are we to teach this doctor to administer? It is useless our even suggesting other than "something out of a bottle", as we know full well that in 9 cases out of 10 that is all he possesses. I suggest ethyl chloride or a mixture of chloroform and ether followed by *open* ether. If this is taught it can be made to cover most cases that come within the sphere of the general practitioner. Granted there are pleasanter forms of induction but are they as safe and do they fit into the social conditions under which a number of country doctors have to work? This method has been designated by some of my colleagues as barbaric and criminal. I feel that it must be lack of skill on the part of the administrator rather than the method which calls for such criticism.

Having just returned from the celebration of the centenary of chloroform in Edinburgh, I am sure the Scottish general practitioners use chloroform for their minor surgery, and as this agent is better taught there than down South, I am not

sure they are not right, although they are honest enough to own to a mortality rate.

If we agree that occasions do arise when there is a real necessity for open anæsthesia, then it is up to us to teach such methods. Also, are not these open methods the fundamental basis on which to build our future knowledge? To start our instruction on a Coxeter Mushin or McKesson apparatus would seem to me to be putting the cart before the horse.

Now we cannot limit our activities to teaching the country doctor, we need to deal also with the ever-growing mass of institutional doctors shortly to become National Health employees. Here I am assuming that as long as the necessary forms are filled in, probably in quadruplicate, we shall no longer have to worry about the expense of apparatus, bed accommodation and the hundred-and-one social conditions which so influence the present day anæsthetist. Everything will be standardized including the anæsthetic, so what anæsthetic shall we select to teach the student? which will cover the greatest number of cases? be reasonably pleasant, easy to teach and carry a low mortality? I would suggest omnopon and scopolamine premedication followed by pentothal sodium and then gas-oxygen, ether sequence. This sounds fairly easy but to me is far from it. The mental strain of watching a medical student do his first intravenous pentothal when you can see from the word *go* he is liable to put it anywhere except into the vein is almost more than I can stand.

I would here and now put in a plea that all students before becoming anæsthetic clerks be taught in any department of the hospital except ours to do:

1. Intravenous punctures.
2. Lumbar punctures.

For ordinary teaching purposes the simple Boyle's machine, devoid of all accessory knobs and excresences which seem to multiply day by day, would appear the most suitable.

The teaching of closed circuit apparatus or methods is not advocated, once again on the grounds of lack of time

available. This automatically excludes the use of cyclopropane, which to my mind is highly desirable as I should certainly classify it as one of the agents to be used by specialists only.

Spinal Anæsthesia, the technique and variety of methods of administration and suitability of patient is a debatable subject even among the highly specialized administrators, therefore, I feel there is no simple short cut that can be taught to students, who probably during their month's course will only see one or two cases, and it is therefore much better omitted.

The use of pentothal sodium not only as an induction but also for short cases is so universally accepted that I feel it is essential to teach it, stress being laid on the dangers, limitations and methods of resuscitation.

Intubation, direct or blind—here I am definitely in a quandary, and personally feel its introduction was the greatest milestone in the rapid advance of modern anæsthesia, but I am unable to make up my mind whether we shall do more harm to future patients by leaving it untaught than by turning out a number of doctors who have had inadequate practice under supervision. Perhaps we should limit ourselves to trying to teach the direct method, but with the time and material available I am inclined to suggest it should be omitted.

Curare is referred to by some as the wonder drug, quite rightly. I always wonder what is going to happen each time I give it. Here I would be dogmatic and definitely state that, in our present state of knowledge, its administration is well outside the province of any except the experienced anæsthist.

In conclusion I would suggest that:

1. Dental anæsthesia;
2. Maternity analgesia and anæsthesia;
3. Open anæsthetic methods;
4. Use of Boyles machine;
5. Use of pentothal sodium;

are essential subjects to be taught to all medical students.

The question of spinals and intubations is debatable.

Absorption technique, cyclopropane, curare, should not be taught.

I must apologise for only having touched upon a few salient points of this subject, but have purposely cut the address short in order to allow time for our guests and members to give us the benefit of their views on this subject.

INTRAVENOUS ANÆSTHESIA, PAST AND PRESENT

By Reginald E. Pleasance, M.D., D.A.
Lecturer in Anæsthetics, The University of Sheffield

ALTHOUGH the first successful intravenous anæsthesia in man dates as far back as 1872, this form of anæsthesia has received many setbacks since its inception. Its early development was retarded by lack of suitable agents. The introduction of derivatives of barbituric acid has played an important part in popularizing, and in giving, intravenous anæsthesia a justifiable place.

It is difficult for us to realize that until approximately ten years ago this form of anæsthesia was the exception, rather than the rule.

Historical

We all know that Dr. Crawford Long in 1842, and Dr. Wm. T. G. Morton in 1846, administered ether by inhalation to produce general anæsthesia. It was not until thirty years later that the first drug was injected intravenously, namely chloral hydrate, by Oré of Lyons, France, in 1872.

One can understand that, with the uncertainty of general anæsthetic agents as then known, any new method would be of great interest.

As far as is known the credit for the first discovery of a method of conveying liquors directly into the blood-stream may be attributed to Sir Christopher Wren, the famous architect. His experiments were carried out in the house of the French Ambassador, the Duc de Bordeaux, in 1656. Wren was at that time Professor of Astronomy at Oxford. He ligated the veins of a large lean dog, made an opening in the vein on the side of the ligature nearest the heart, and injected opium by means of an animal bladder, to which a quill was attached.

He found that this stupified, but did not kill the animal. On the other hand when he injected a dose of crocus metallorum the dog started to vomit and died. He was, however, unaware of the anæsthetic results of the injection of opium.

Probably the first genuine attempt (as suggested by Jarman) to produce intravenous anæsthesia was made in 1665, when Sigismund Elsholtz injected an opiate to produce unconsciousness.

In 1654, Francesco Folli of Florence reported the successful transfusion of blood to animals, and this was repeated by Daniel of Leipzig in 1664.

At about this time (February 1665) Richard Lower transfused blood to animals for the first known time.

On June 15th, Jean-Baptiste Denys of France, with the help of a Dr. Emmerez, first transfused blood to man. Dr. Lower's results were published in the Philosophical Transactions of the Royal Society for December 17th, 1666, and Dr. Denys' experiment was published in the same Transactions on July 22nd, 1667.

Lamb's blood was used in most cases, but in some of Denys' cases he used the blood of calves. So severe were the reactions in some cases, leading to death in one patient at least, that blood transfusions were abandoned, unfortunately, for many years.

Thus the injection of fluids was a much older procedure than the injection of anæsthetic agents.

The first record we have of any method concerned with the

venous system was that introduced by the ancient Assyrians, who compressed the veins of the neck, and probably the carotid arteries as well, to produce a temporary unconsciousness prior to the operation of circumcision.

James Blundell, a distinguished English obstetrician and physiologist, reopened the subject of transfusion of blood. Many of his patients had died from puerperal and post-partum hæmorrhage. He felt that these might have been saved if they had had transfusions of blood. He postulated that the blood should come from an animal of the same species.

He was the first to transfuse human blood to a patient. According to Sturgis, out of ten patients thus transfused five died and five recovered.

In 1831, Latta of Leith, in Scotland, introduced the practice of intravenous saline solutions in cases of severe collapse.

The introduction of the hypodermic syringe in 1845, by F. Rynd of Edinburgh, and the hypodermic needle (credited by most authors to Alexander Wood) was another milestone in the development of the technique.

Chloral hydrate as used by Oré was not well suited for anæsthesia, so in 1899, Dreser of Munich introduced hedonal; and in 1905, Krawkow and his co-workers at St. Petersburg demonstrated its value for anæsthetic purposes.

Fedorow of St. Petersburg reported on 530 cases, in which he used hedonal as an anæsthetic agent in a physiological solution of sodium chloride.

The first volatile anæsthetics used intravenously were chloroform and ether, by Burkhardt in 1909. It need scarcely be added that the former did not prove satisfactory, and the latter found little favour.

In the same year Bier used the regional intravenous method of obtaining anæsthesia of the limbs. He injected a solution of procaine hydrochloride into the veins near the site of the proposed operation.

In 1912, J. Goyanes of Madrid reported on the intra-arterial use of procaine hydrochloride.

Paraldehyde was used by Noel and Souttar in 1913, but its use intravenously was limited.

Peck and Meltzer reported upon the use of intravenous magnesium sulphate, but only a few cases were recorded, and its use seems to have been soon abandoned.

Morphine and scopolamine were used about the same time by Bredenfeld, and since then the intravenous injection of morphine has been found most useful, for purposes other than anæsthesia.

Ethyl alcohol was first used intravenously, in 1921, by Naragawa of Japan. For the next ten years numerous experiments were made with this agent.

Intravenous ether was again reported upon in 1913, but this time in combination with isopral. Separate containers were used for each agent. These were connected to the same cannula. The isopral was administered first, and was infused until anæsthesia began to appear. The injection of isopral was then discontinued and the anæsthesia maintained with ether.

The first barbiturate to be synthesized was barbital or veronal, by Emil Fischer and von Mering in 1903. The first to be used as an intravenous anæsthetic was somnifaine. It was a long-acting drug, very slow in producing anæsthesia, and, as a result, it left patients in a deep sleep, which lasted from 24 to 48 hours. Others in this group were phenobarbital, soneryl, dial, and neonal.

Daniel and Gabriel Bardet published a paper on somnifaine, in 1920, describing its anæsthetic properties, and Ferdet and Perlis introduced the intravenous technique of administering the drug. They gave their patients a preliminary subcutaneous injection of morphine and scopolamine before injecting the somnifaine. The patients slept for a considerable time, and when roused, complained of severe headache and drowsiness.

In the same year dial was used.

Pernoston or pernocton was the first barbiturate to be used widely for general intravenous anæsthesia, and was very popular in Germany.

In 1929, Zerfas and McCallum, and others, reported upon the use of sodium amytal intravenously, as did Lundy. In the United States of America this drug was used extensively from 1929 to 1933. It is still used regularly for the treatment of mental patients.

The intravenous use of pentobarbital sodium (nembutal) was reported by Fitch, Waters, and Tatum, in 1930.

The first real step in progress was made when evipan was discovered. It was first synthesized by the chemists Kropp and Taub, and a report on its pharmacological and clinical effects made by Weese and Scharpff.

It combined two valuable properties from an anæsthetic point of view: rapidity of action and shortness of anæsthetic effect, One of the earliest papers on the drug was published by Jarman and Abel in 1933.

In 1934, Lundy introduced the technique of intermittent intravenous administration of pentothal sodium. It was found to be far more potent than evipan, and gave better relaxation. So far this is undoubtedly the best agent we have for the production of general anæsthesia by intravenous injection. The drug is potent, acts promptly, is rapidly detoxicated and eliminated, and has few deleterious side actions. For this reason I wish to confine my subsequent remarks to the action and uses of pentothal sodium.

The Chemistry of Pentothal Sodium.

Pentothal sodium (syn. sodium thio pentobarbital) is sodium ethyl (1-methylbutyl) thiobarbiturate. It is an amorphous powder, light yellow in colour, with a distinctly sulphurous odour. Readily soluble in water and alcohol, forming a strongly alkaline solution. The powder is somewhat hydroscopic. To prevent hydrolysis, with the separation of the free acid, a buffer, in the form of sodium carbonate, is added to the commercial preparation. The pH of a 2.5 per cent solution is between 10.4 and 10.6. It dissolves readily in water, forming a light yellow, clear and translucent solution.

It is supplied in ampoules of 0.5 to 1.0 gm., the only addition to the salt being 6 per cent by weight of carbonate of sodium, to give stability.

A solution mixed in a syringe and left, if not exposed to the air, will last for one or two days, or even longer. If there is any sign of opacity or any visible foreign matter, the solution should be discarded. The pentothal sodium should be dissolved in triple distilled, chemically pure water only. It is not a bad technique to wash the syringe used with 1 cc. of the distilled water before mixing the whole of the solution.

Numerous dilutions have been used. In this country we favour a 5 per cent solution, but in America they prefer a 2.5 per cent solution.

Much work has been done to determine the toxicity, potency, and effects on the various organs, but there is still much to be settled. We know, however, that it causes varying degrees of hypnosis, sedation, analgesia, anæsthesia, and respiratory depression, depending on the dose employed, and the method of administration.

The effect is produced rapidly, and, provided only one dose is administered, wears off rapidly. The patient recovers without any after effects.

Respiratory System

Depression of respiration is its foremost effect, the degree depending on the amount administered, and the rate of injection. Complete arrest may occur, but as the heart continues to beat one is able to maintain life until the depression of respiration has been overcome.

It is of interest to note that if a lethal dose in animals is injected rapidly then the heart will cease to beat soon after the respirations have failed.

The part played by respiratory stimulants, in cases of overdose, is of interest. The administration of oxygen and carbon dioxide, together with artificial respiration, forms the most effective measure. It would appear that in such cases the

injection of drugs such as coramine, metrazol, picrotoxin, etc., is of doubtful value.

So long as the circulation is maintained adequately by artificially ventilating the lungs, to give the body time to overcome the overdose, respiration will be established spontaneously.

Adequate pulmonary ventilation, as well as a good colour of the blood, is very important to prevent carbon dioxide accumulating in the tissues, and the use of carbon dioxide as a respiratory stimulant is contra-indicated unless artificial respiration is being given.

The beneficial effects of giving oxygen during pentothal anæsthesia are apparent, especially if cyanosis is present.

So far as the heart muscle is concerned, it has been shown by the Cushny myocardiograph that there is a marked decrease in the force of the contractions of the auricles and ventricles, with a simultaneous dilatation or increase in the volume of the heart, leading to weakened force of contraction.

Effects

Unconsciousness is produced rapidly and pleasantly. After a period of quiet, the patient passes into a state of anæsthesia, without any evidence of excitement. Muscular relaxation is variable, but as a rule, so well marked in the neighbourhood of the jaw as to require somebody at hand to support it. Unlike evipan, muscular twitchings are rarely seen.

The degree to which blood-pressure falls depends largely upon the rate of injection of the solution. If the injection is rapid the fall in blood-pressure is pronounced. As a rule recovery takes place after a short interval. Respiration is depressed, the amplitude being affected more than the rate. Here again the rate of injection has a marked effect upon the degree of depression. If slow, the respirations may not cease at all.

If fairly rapid, after the injection of from 5 to 6 cc. of the

5 per cent solution, respiration ceases. After a pause of from thirty to forty-five seconds it spontaneously begins once more.

If very rapid, respiration will cease, and may remain without any attempt at recovery for some five to ten minutes, during which time the patient will require aided respiration to maintain life.

Even if one continues to inject pentothal slowly, whilst there is no evidence of respiration, without a safety pause, after from 12 to 14 cc. have been given spontaneous respiration can occur.

Luckily the sequence is fairly regular for each individual. Inject say 6 cc. rapidly. The respirations become very pronounced for a very short period. They then cease altogether. After a pause they slowly return. If the injection is then continued at a fairly rapid rate, immediately before the patient is becoming deeply anæsthetized the amplitude of respiration again becomes pronounced, before ceasing for a second time.

Thus we have, as in other forms of anæsthesia, a very sure guide to the depth of anæsthesia by watching the respiration.

The pulse rate is accelerated at least four to ten beats per minute.

The colour remains good as a rule, but in certain types of patient, blueness becomes fairly well developed. In such cases it is a wise precaution to give continuous oxygen at the same time as the injection is being made.

The eyes are not very reliable as a sign of anæsthesia. At first the pupils may dilate a little, but later they become smaller than normal, central and fixed.

Very occasionally tremors are observed, and if given too quickly, hiccough may develop, which is usually cured by giving a little carbon dioxide.

Laryngeal spasm may occur in the early stages of anæsthesia. In my experience it is usually due to too light anæsthesia, and is rarely seen if an adequate dosage is given. One of the best ways to produce it is to be too eager to insert an airway as soon

as the jaw relaxes, or again, if the surgeon begins to operate before the patient has had time to settle down.

The stages of anæsthesia are well defined to one accustomed to this method.

(1) Light narcosis. During this period the outstanding feature is a feeling of inebriation, visibly expressed by a drunken grin, loss of fear, a delayed cerebration, followed by yawning and unconsciousness. Occasionally a complaint is made of a taste of sulphur at the back of the throat.

(2) "Stage of inebriation." Response to pain still present, but not to lesser stimuli. At this stage the knee jerks are exaggerated.

(3) Anæsthesia. No response to painful stimuli. The blood-pressure may fall as low as 80–90 mm. Hg. Respiration is shallow; the tongue falls back; the corneal reflex is abolished; the pupils contracted and fixed; superficial and deep reflexes diminished or absent; the rectal sphincter may be partially relaxed.

(4) "Pre-mortem stage." All reflexes seriously depressed or absent. The blood-pressure is at shock level.

Recovery is quiet, but occasionally the patient is irrational, noisy, and hyperactive, needing restraint and supervision until this stage is passed.

Equipment

A 20 cc. syringe with an eccentric nozzle, and needle size 14, with a short bevel, for intermittent doses.

For continuous anæsthesia the apparatus designed by Jarman and Abel is excellent. The syringe has a three-way nozzle. In the central position the syringe communicates directly with the vein. Turned to the left, the position can be used for intravenous glucose saline. To the right the syringe communicates with the pentothal solution.

Selection of cases and premedication

This depends on whether the patient is an out-patient or an in-patient. In the former case atropine can be given with

advantage, omitting the morphine. In the latter the best form of premedication is the hypodermic injection of morphine gr. 1/6 and atropine gr. 1/100 at least one hour before operation. The atropine is especially useful in preventing the tendency to laryngeal spasm, especially if a supplementary anæsthetic, such as ether, is used; whilst the morphine will diminish the amount of pentothal required.

The stomach should be empty and no solid food given for at least four hours before operation. The bowels should have the routine preparation and to prevent over-distension the bladder should be emptied before the injection is made.

Administration

Where possible I use the crucifix position. A board, with a piece cut out of the width of the operating table, so as to lessen the thickness under the patient, is placed in position under the shoulders. Each arm is then lightly fixed in the extended position. One is thus able to use either arm for the intravenous anæsthesia or for blood-pressure recordings, without disturbing the surgeon or his assistant.

The pentothal and ampoule of chemically pure sterile distilled water should be placed in a bowl of spirit. Near at hand, in case of emergency, a bottle of picrotoxin containing 20 cc. (0.3 per cent solution), and coramine in 5 cc. ampoules.

An apparatus for inflating the lungs, if necessary, such as as McKesson or modified Boyles apparatus.

Also some form of suction apparatus.

There are three recognized methods of injection.

(1) The single dose method.
(2) The intermittent dose method.
(3) The continuous dose method.

Of these the first two are eminently suitable for general use. I personally recommend that the technique used should depend entirely upon the experience of the administrator.

Thus in the case of students or beginners the following technique is taught.

(*a*) The injection of the first 4 or 6 cc. is made slowly.

(*b*) A pause should be made at the end of the injection to watch the effect on respiration. (The so-called safety pause.)

(*c*) Some anæsthetists like the patient to count during this period, and stop the injection as soon as they stop counting. An equal amount to that already given is then injected, as soon as the respirations are visible.

Personally I teach the student to watch the respirations, to wait for the depression or cessation of respiration, and then to stop injecting until they become visible again; then to inject an equal amount to that already given, at a fairly deliberate rate.

With added experience I make them continue the injection until the respirations become deeper, and then to stop.

For the intermittent method the needle is left in the vein, and further quantities of pentothal injected 1 cc. at a time as required.

Since the advent of curare I have abandoned the continuous method of intravenous anæsthesia, as I feel that the technique is unnecessarily complicated for the results obtained.

My present preference so far as technique is concerned is as follows:

The patient is premedicated with morphine gr. 1/6th and atropine gr. 1/100th. Induction is carried out with pentothal, 6 cc. being given rapidly. Respiration invariably ceases. A pause is made until the respiration is visible again. Pentothal is then injected until the respirations cease once more. This is usually preceded by an increase in the amplitude of the respiratory movements. The usual amount in an adult to produce this result is approximately 16 cc. of pentothal, provided the injection is fairly rapid.

Either an airway or an endotracheal tube is passed under the pentothal injection alone, but prior to this the lungs are gently inflated with oxygen.

The respiration is aided by pressure on the rebreathing-bag,

until the movements are spontaneous. The mixture given until this occurs is 33⅓% oxygen and 66⅔% nitrous oxide.

As soon as the patient begins to breathe spontaneously an injection of 10 mg. of curare is given.

To err on the side of safety it is my opinion that the student should be taught the following principles:

(1) To select the suitable case.
(2) To inject slowly and intermittently.
(3) To maintain a free airway.
(4) To have adequate supplies of oxygen at hand.
(5) To be prepared for the relief of respiratory or cardiac failure.

What is the suitable case? The more one makes use of intravenous pentothal anæsthesia the more one feels that contra-indications are few.

Amongst these I would list:

1. Cardiac disease with decompensation.
2. Hypotension.
3. Severe liver disease.
4. Severe renal disease.
5. Severe cachexia, anæmia, and dehydration.
6. Cases of dyspnœa from any cause.
7. Acute or chronic obstruction of the respiratory tract, such as œdema of the glottis, Ludwig's angina, etc.

I use the word severe, because one knows by experience that if one uses discretion in the dosage, even in the above cases, pentothal can be a suitable anæsthetic agent.

There are three types of case which always cause me to pause and think, and hence to be cautious.

First and foremost, cases of bronchiectasis. These always react unfavourably. They become cyanosed, and in a certain number of cases, seem to develop bronchiospasm.

In the past three years I have had three patients who could easily have died, but owing to strenuous efforts, were able to survive.

Case No. 1. Advanced bronchiectasis; for bronchoscopy.

After 6 cc. pentothal the colour became livid. The appearance was corpse-like. Inflation of the lungs was attempted without success. The bronchoscope was passed, suction maintained, and oxygen under pressure insufflated. After forty-five minutes the colour returned.

Case No. 2. Similar to the previous case, except that in this case the colour returned after fifteen minutes.

Case No. 3. For teeth extractions. Receding jaw; bad chest, stated to be a chronic bronchitic. After 6 cc. pentothal, colour livid; appearance of impending death. Inflation of the lungs successful after twenty minutes. Owing to the receding jaw the laryngoscope was at first unsuccessfully applied. After twenty minutes the tube was passed and the patient coughed up pure pus. The teeth were then extracted without further trouble.

Then again the fat, thick-necked, plethoric type of patient, especially if they have a receding chin. Unless care is exercised they seem to delight in going into spasm.

Finally the case of intestinal obstruction, where a spinal is contra-indicated. Twice I have had cases in which, after a small amount of pentothal has been administered, the back of the throat became full of thin brown liquid, necessitating prompt action to prevent a catastrophe.

One such case was an old lady of 85 years of age. She was supposed to have had gastric suction for the past three hours. As soon as the pentothal was administered the trouble began. Copious fluid regurgitated. The patient was livid and almost pulseless. After a strenuous fight for twenty-five minutes, during which time the surgeon had given her up, she was intubated and had a resection of colon lasting for one hour and three-quarters. Subsequently, she had a local anæsthetic. Eventually she had to have another general, but this time all went well.

These are the type of case about which I feel there is definite danger in using pentothal as an anæsthetic agent.

Provided, however, one realizes this danger, and that one is

prepared to meet these distressing emergencies, even then, all will be well.

A word about the extremes of age. It has been stated that these are contra-indications for the use of pentothal. Personally I have no fears in using pentothal in old people. So far as young children are concerned, however, I like to restrict its use to children over the age of six. Even then I prefer to go by body-weight rather than age.

Uses

Pentothal anæsthesia has very definite uses. For minor procedures it gives a pleasant anæsthesia which has very little or no after effects. For example: dilatation and curettage, reduction of fractures and dislocations, incision of abscesses, in fact, for any minor operation.

Where the cautery or diathermy is used.

For an easy and pleasant induction. As we all know, in these days the patient often says, "Are you going to give me pentothal?" and then stretches out one arm.

For basal narcosis.

For a complemental anæsthetic agent.

For the relief of convulsions produced by poisoning from local anæsthetic or ether, or in the case of tetanus.

Obstetric Practice

Pentothal is chiefly of use in the later stages of labour, or a short while before delivery.

There does not appear to be any undue respiratory depression, or asphyxia of the baby, although there may be some impaired power of the mother to bear down.

About 7 cc. is all that is necessary for the average case when the head is on the perineum.

For Cæsarean section I have used pentothal for induction in doses of 6 cc. of the 5 per cent solution, without any after effects on the child. Solomons reported on the use of pentothal sodium in forty-three obstetric cases, in which he employed total doses

of 10 to 18 cc. of a 10 per cent solution. He said that morphine, scopolamine, or pentothal sodium, can be safely administered for premidication.

Laryngoscopy, Bronchoscopy, Œsophagoscopy, Gastroscopy

These examinations are not very satisfactory under pentothal sodium anæsthesia. One may relax the jaw perfectly, but as soon as the surgeon attempts to pass a bronchoscope there may or may not be trouble. Especially is this the case where a diagnostic biopsy is to be made for cancer. These patients often have an embarrassing cough, and I have given 1½ gm. of pentothal without eliminating this cough reflex.

I have found that to induce with 10 cc. of a 5 per cent solution, and to allow the patient to breathe gas and oxygen mixture, with a minimum of trilene will allow one to perform these procedures without much trouble.

Now, of course, we are able to make use of curare, which has altered the situation entirely.

Disadvantages

What are the disadvantages of pentothal anæsthesia? First of all its action is not reversible. Once the drug has been injected, one has to wait until it has been detoxicated.

The reflexes are not necessarily abolished. Unfortunately the laryngeal and pharyngeal reflexes remain, and laryngeal spasm is liable to occur.

This type of anæsthesia is only suitable for a limited type of operation, although for induction purposes its use can be almost universal.

The severe respiratory depression, unless one is used to dealing with such a condition, can be worrying.

Muscular relaxation is apt to be good in some cases and definitely bad in others.

An assistant is really necessary to maintain anæsthesia safely.

Complications

The most important complications that can occur are venous

thrombosis; inflammation of the subcutaneous tissues; vomiting; jactitation; and finally, intra-arterial injection of pentothal resulting in extensive thrombosis.

Venous Thrombosis

I have only seen three cases of venous thrombosis. These occurred during the war. One was after the injection of a 5 per cent solution of pentothal. In this case a second injection at a later date caused no ill-effects. The second case was after the injection of a 2.5 per cent solution, and the area where the thrombosis occurred was at a situation remote from the site of injection. The third occurred in a dental surgeon who was being operated upon for a simple whitlow. The amount of pentothal used was small and the operation of short duration. I suspected the sterilizing of the needles.

Inflammation of the Subcutaneous Tissues

I am pleased to say that so far I have not seen any trouble due to this. I have, however, seen a soldier in the Middle East who had an arm in which the tissues round the forearm were scarred and contracted, following the extravenous injection of a full dose of pentothal.

Vomiting

I have already referred to the regurgitation which may occur in cases of intestinal obstruction. The importance of an empty stomach is emphasized in the following case.

An officer, aged 56 years, of the, shall we say, plethoric type, fell and fractured the neck of his femur. The surgeon insisted on an immediate operation. I refused to give the anæsthetic as he had only just had his dinner. Another anæsthetist was impressed or coerced, and duly gave about 4 cc. of soluble hexobarbitone before the patient began to vomit large amounts of undigested food. He became deeply cyanosed, especially round the lobes of his ears. After rapidly cleansing his nasal passage, as well as was possible, I was fortunate enough to pass

a Magill's tube blindly, during an attack of coughing. He made an uneventful recovery, and congratulated the anæsthetist on the best anæsthetic he had ever had.

Jactitation

Luckily this is very rare with pentothal. I think it is caused by too rapid injection of the drug, a deficient airway, and the injection of a solution which has only been made up immediately before injection.

Intra-arterial Injection of Pentothal

This is an accident which, so far, has eluded me, I am pleased to say. Macintosh and Heyworth described two cases in which this had occurred. Similar cases have been recorded by Lundy and others. Adams recorded a case in which, although it was recognized at the time, the injection was continued, without any untoward results.

The symptom which should cause it to be recognized immediately, apart from the colour of the blood in the syringe, is an agonizing pain down the arm to the fingers.

Post-operative Care

Entirely depends upon the amount of pentothal given. In any case the patient should always be watched until reflexes have returned or even consciousness. I know of a case which was left unattended after simple extractions of teeth. When seen later he was dead.

Even after short anæsthesias patients should not be left unattended, when apparently normal and conscious. Some patients have been known to have a period of complete amnesia, although apparently normal, and to be totally irresponsible for their actions whilst in this condition. A few may recover consciousness and then have a second period of unconsciousness. Some show excitement and marked aggressiveness. The treatment is an early dose of morphia.

For over-dosage or persistent depression of respiration

coramine in intravenous doses of 5 to 10 cc. is indicated. Picrotoxin, 2 to 3 cc. of a 0.3 per cent solution at intervals of fifteen to twenty minutes is also excellent. Not forgetting oxygen and carbon dioxide and, if necessary, the use of the McKesson or any other apparatus which is capable of giving oxygen under pressure.

Mortality

In skilled hands this appears to be very low. So far, I have not had any deaths due to this form of anæsthesia. Jarman claims 45,000 cases without a death.

Conclusion

I feel that in the past ten years, and especially during the war years, intravenous anæsthesia has proved its worth, and has established itself as a safe and reliable means of producing anæsthesia.

The advent of curare has only served to enlarge the scope of intravenous anæsthesia, and to add to the comfort of the surgeon, although it cannot be denied it has at the same time added to the responsibilities of the anæsthetist.

References

Adams, R. Charles. "Intravenous Anæsthesia" 1st edition.
Beecher, H. K. "The Physiology of Anæsthesia", 1940.
Jarman, R. *Post-Graduate Medical Journal*, 1946, xxii, 252.
Keys, Thomas E. "History of Surgical Anæsthesia", 1945.
Pleasance, R. E. *The Medical Press*, 1946, No. 5615, 467.
Robinson, V. "Victory Over Pain", A History of Anæsthesia, 1946.

CORRIGENDA

January 1948 issue: page 14, line 30
for "I gave 1.0 gm." *read* "I gave 10 mgm."

ANÆSTHESIA FOR UROLOGICAL SURGERY

By HERBERT H. PINKERTON, M.B., CH.B., D.A., F.R.F.P.S.G.
Joint-Lecturer in Anæsthetics, University of Glasgow; Anæsthetist, Western Infirmary, Glasgow.

(Lecture delivered at the Royal College of Surgeons of England, April 1948.)

IN urological surgery, the bladder and its attendant organs and passages demand the major part of the surgeon's attention, and as the nerve supply of those regions arises from a limited length of the spinal cord, it is to be expected that spinal analgesia will be called upon to play a regular part in anæsthetic methods for this special type of surgery. It is fitting therefore to consider the nerves which require to be blocked in the various operative techniques.

It is apparent that anatomists and physiologists have had some difficulty in deciding the exact origins of the varied nerve supply of the bladder, and if the views of some authorities are accepted, certain clinical phenomena are left unexplained. On the other hand, a patient search in odd places has furnished information which tallies with clinical results, and it is to this that definite reference will be made. First, however, there are the nerve origins upon which there is general agreement—(*a*) the *somatic* nerve supply, travelling in the pudendal nerve with its origin in sacral roots 3 and 4, and supplying the external sphincter and the urethra as well as the genitalia in part; and (*b*) the *parasympathetic* nerve supply with origin in sacral roots 2 and 3, and supplying the mucous membrane of the bladder and the remainder of the sphincter mechanism. *Afferent* sensory impulses travel in the fibres of both supplies, as well as efferent motor impulses.

The discrepancies appear when the *sympathetic* supply is under consideration, and it is here that leave is taken to quote authorities whose views agree with clinical findings. Riddoch (1921)[1] pointed out that the sympathetic trunks do carry afferent impulses from the bladder, and that section of the spinal cord above the eleventh dorsal segment abolishes all vesical sensation. Learmonth (1931)[2] presented evidence concerning the segments of the spinal cord with which the sensory fibres running with the sympathetic nerves connect. He described a case which showed that these afferent fibres may enter as high as the ninth thoracic segment. Ignoring the vague descriptions of some anatomy books on this topic, Quain[3] records these origins:

Bladder

(*a*) Mucous membrane and neck of bladder—S.(1), 2, 3, 4.

(*b*) Overdistension and ineffectual contraction—D.11, 12 and L.1.

Incidentally, it may be noted here that he also records:

Kidney and ureter—D. 10, 11, 12, and
Prostate gland —D. 10, 11, (12)
—S. 1, 2, 3 and L. 5.

Supported by these authorities, it may reasonably be accepted that there is a *sensory* nerve supply to the bladder and prostate with origins at least as high as the tenth thoracic segment, and when a spinal anæsthetic is chosen for urological work which involves distension of the bladder or cutting of the prostate gland, it is well to keep this unexpectedly high segmental origin in mind. There is a temptation to attempt such operations as litholapexy or transurethral resection of the prostate, using a "low spinal" anæsthetic. The reasonable distension of the bladder which is likely to occur in each case and the insult to the gland in the latter will produce evidence in the form of a grunt or grimace that anæsthesia is not quite complete unless its level has reached this tenth dorsal segment.

It is less the concern of the anæsthetist that *efferent* impulses may have an even higher origin (Fig. 1).

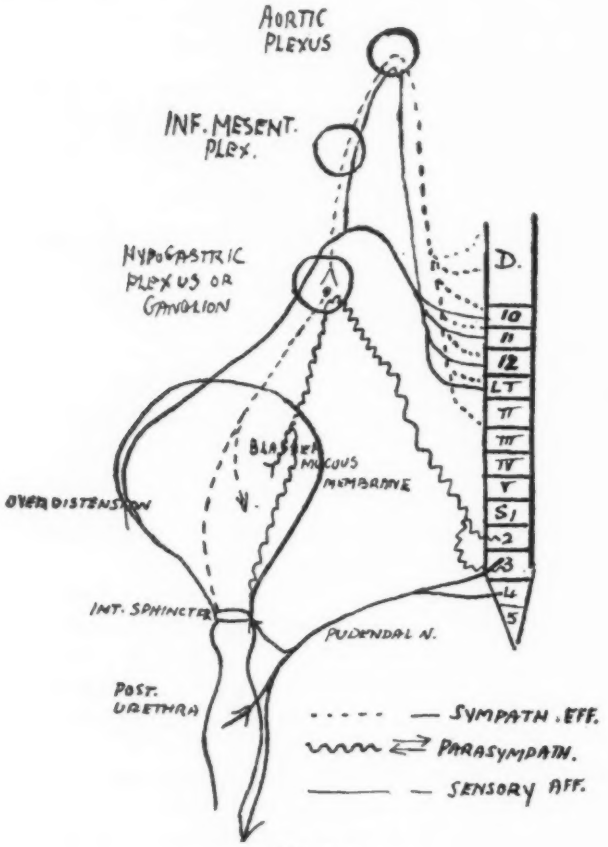

FIG. 1

Before leaving the anatomical aspects of urological surgery, the origin of the nerve supply to the skin areas through which the surgeon progresses to his target might be mentioned. These

areas are covered by a nerve supply from D.8-12, except for the genitalia which share a sacral outflow and also branches from the ilio-inguinal and lumbo-inguinal nerves.

Transurethral Procedures

Forearmed with some anatomical knowledge, consideration can be given to the methods of anæsthesia which are suitable for urology, and attention will be paid first to the out-patient. Most patients—male and female—attending a urological dispensary are examined by the skilled urologist without anæsthesia and little or no discomfort is experienced. But there are always some who do require anæsthesia, and their needs are met by a choice from (1) local analgesia, (2) spinal analgesia or (3) general anæsthesia.

(1) *Local analgesia* may be produced by the instillation into the urethra of one ounce of 1:500 nupercaine or of 2 per cent metycaine. The use of cocaine should be avoided as reactions from this drug are not uncommon in this region. Mild barbiturate premedication is worthy of consideration in view of the well-recognized antagonism between local analgesics and this class of drug.

(2) S*pinal analgesia* provides an effective and easily applied method. A small dose of procaine, 60–80 mg. made up in heavy solution (0.3–0.4 c.c. of 20 per cent solution) is injected at the 3rd or 4th lumbar interspace with the patient sitting up. Remaining in this position, or comfortably reclined on the urological table at an angle of about 45°, only the sacral roots become involved. Somatic and parasympathetic afferents are blocked and as long as the bladder is not distended, cystoscopy and treatment of the bladder mucous membrane (S.(1), 2, 3, 4) can be carried out (e.g. fulguration of papilloma). The analgesia does not involve the kidney or ureter, and retrograde pyelography can be readily performed, the necessary sensation being retained in the kydney pelvis. As there is no sympathetic involvement no fall in blood-pressure ensues, and no pressor drug is given. It should be remembered that the

skin on the outer part of the soles of the feet is supplied by the sacral roots, and the patient should be warned of the woolly feeling in this area. The main sensory supply to the lower limbs and the entire motor supply are unaffected and the patient should have no difficulty in walking away at the conclusion of the examination. After resting for an hour, the patient is allowed to leave the dispensary, with a recommendation to take things quietly for the remainder of the day.

Extradural sacral block or caudal block provides a satisfactory analgesia, but the technique is less simple than for spinal analgesia, and great care must be taken to avoid too high a spread if pyelography is under consideration. Spinal analgesia demands no delay before it is effective, but caudal block requires 10–15 minutes to secure efficient results.

(3) There are patients for whom it is preferable to choose a *general anæsthetic* even in an out-patient clinic, and their needs are well supplied by the use of intravenous pentothal. If the operative procedure or examination is at all prolonged, the patient will recover more quickly if the anæsthesia is maintained with gas and oxygen following pentothal induction, than if the pentothal is continuously administered.

Going on now to procedures which entail some overfilling of the bladder, namely litholapaxy and transurethral resection of the prostate, it has been shown already that the anæsthesia must be raised to the tenth dorsal segment when spinal analgesia is chosen. The subarachnoid injection is made with the patient again sitting up, choosing the 3rd lumbar interspace. One hundred mg. of metycaine [Gamma—(2 methyl-piperidino) propyl Benzoate Hydrochloride] in the form of 1 c.c. of 10 per cent solution, diluted to 2 c.c. with cerebro-spinal fluid, are injected, and the patient is laid flat *immediately*, elevating the head and shoulders on a pillow. It is important to lay the patient down at once—otherwise the anæsthesia will fail to reach the desired segment. Some fall in blood-pressure is to be expected with this anæsthetic level, and the use of a pressor drug is advised, e.g. ½–1 gr. ephedrine

hydrochloride, given intramuscularly at the time of the spinal puncture. Some prefer to await evidence of a fall in pressure before injecting the pressor drug, but there has been no occasion to regret its prophylactic exhibition. On the contrary, it has served to secure the desired maintenance of blood-pressure until such time as the surgeon has completed the resection and coagulated the bleeding points. The abdominal wall is well relaxed between the umbilicus and the pubis and it is easy to palpate the filling bladder and guide the surgeon as to its condition. A continuous record of the behaviour of the blood-pressure is advisable so that the operator may feel that his coagulation is carried out on a patient who is doing his best to bleed, as it were. The cutting-time in resection seldom exceeds 20–30 minutes, and unless bleeding is excessive the blood-pressure remains at a satisfactory level. On his return to bed, the patient is kept flat, with the usual pillow or two under his head, for a few hours.

When some contra-indication to the use of spinal analgesia exists in such cases, it is entirely convenient to carry out the litholapaxy or the resection under a general anæsthetic. The agents of choice are pentothal sodium intravenously accompanied by gas and oxygen. An intravenous saline drip is primarily established, pentothal is injected into the drip at appropriate intervals while a rich oxygen-gas mixture is also administered. A secure closed-circuit cyclopropane anæsthesia carefully screened from the source of diathermy provides a most satisfactory general anæsthesia for such operations, the blood-pressure being fully maintained in these circumstances.

Suprapubic Operations

Nowadays, suprapubic drainage of the bladder is usually reserved for the patient with retention of urine, and is most often only a temporary measure in the larger plan of fitting the patient for a subsequent prostatectomy. Most cases are suitably dealt with by local analgesic methods, a limited field-

block being employed as the method of choice in these often uræmic patients. It is impossible with such a technique to eliminate the sensation of the distended bladder, but the only discomfort which the patient need experience is the momentary pressure while the trocar is pushed into the bladder. A brief gas and oxygen or cyclopropane anæsthesia will meet these cases unsuitable for local methods.

More extensive suprapubic procedures, e.g. partial cystectomy, fulguration of tumours through the open bladder, may be dealt with under spinal analgesia, but are now most adequately anæsthetized by a light plane gas/oxygen/trichlorethylene or cyclopropane anæsthesia, the necessary muscular relaxation being secured with curare. When cyclopropane is used in the presence of diathermy the circuit must be securely closed and a damp anæsthetic screen should be interposed.

The operation for the extra-peritoneal removal of a low-placed ureteric calculus—an affliction which so often seems to attack the robust—is very comfortably executed under such an anæsthetic technique.

Probably one of the most extensive suprapubic, or rather abdominal, operations facing the urologist, often in a debilitated patient, is transplantation of the ureters, frequently accompanied by cystectomy. Spinal analgesia has probably most often been chosen, supplemented by a light highly oxygenated narcosis, and the technique is commonly successful. But a fair number of these patients operated upon under spinal analgesia are not so well after operation as one would expect—they exhibit pallor, a clammy skin, an anxious look, a rapid small pulse, listlessness and some abdominal distension. They may avoid some of these phenomena if a general anæsthetic is chosen, but they have to be retained in a fairly deep plane for some time. A further objection to spinal analgesia may come from the urologist, whose difficulties are increased by the contraction of the bowel.

As an alternative to the above, pentothal induction followed by a light cyclopropane narcosis has been found very successful,

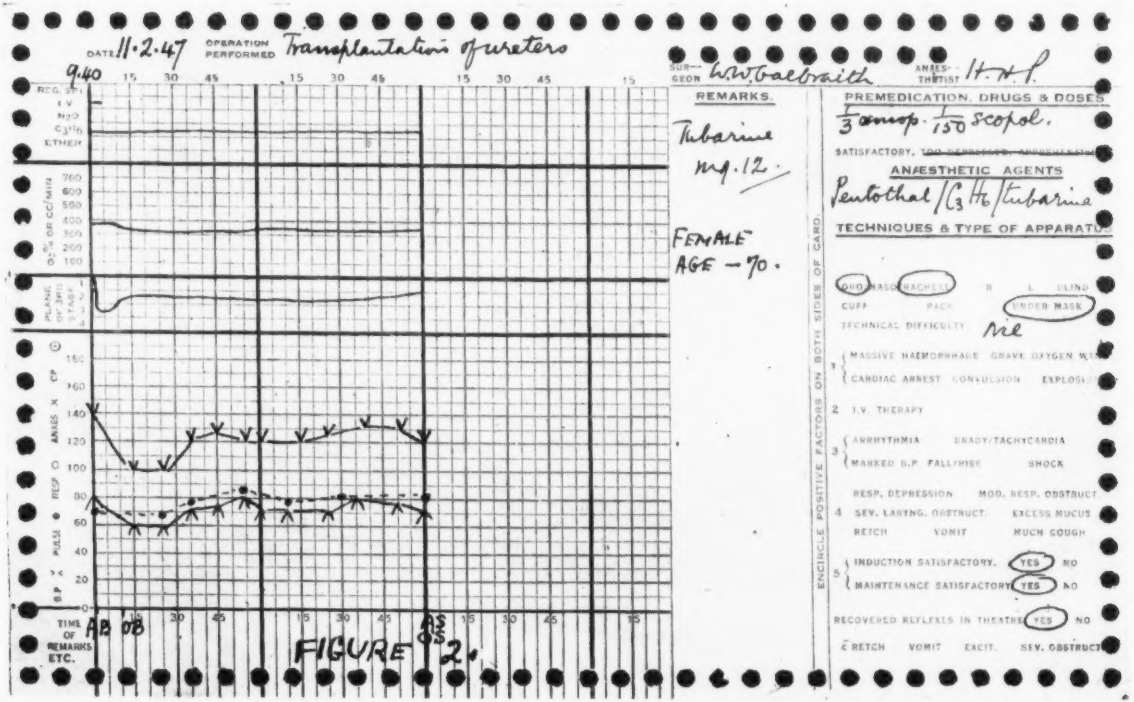
DATE 11.2.47
OPERATION PERFORMED Transplantation of ureters
SURGEON W.W. Galbraith
ANAESTHETIST H.H.P.
9.40
REMARKS.
Tubarine mg. 12.
FEMALE
AGE – 70.
PREMEDICATION, DRUGS & DOSES
1/3 amop. 1/150 scopol.
SATISFACTORY, TOO DEPRESSED, APPREHENSIVE
ANAESTHETIC AGENTS
Pentothal / C3H6 / Tubarine
TECHNIQUES & TYPE OF APPARATUS
CUFF PACK UNDER MASK
TECHNICAL DIFFICULTY Nil
MASSIVE HAEMORRHAGE GRAVE OXYGEN W
CARDIAC ARREST CONVULSION EXPLOSI
I.V. THERAPY
ARRHYTHMIA BRADY/TACHYCARDIA
MARKED B.P. FALL/RISE SHOCK
RESP. DEPRESSION MOD. RESP. OBSTRUCT
SEV. LARYNG. OBSTRUCT. EXCESS MUCUS
RETCH VOMIT MUCH COUGH
INDUCTION SATISFACTORY. YES NO
MAINTENANCE SATISFACTORY YES NO
RECOVERED REFLEXES IN THEATRE YES NO
RETCH VOMIT EXCIT. SEV. OBSTRUCT
ENCIRCLE POSITIVE FACTORS ON BOTH SIDES OF CARD
TIME OF REMARKS ETC.
AB OB
AS OS

FIGURE 2.

H.H.P.

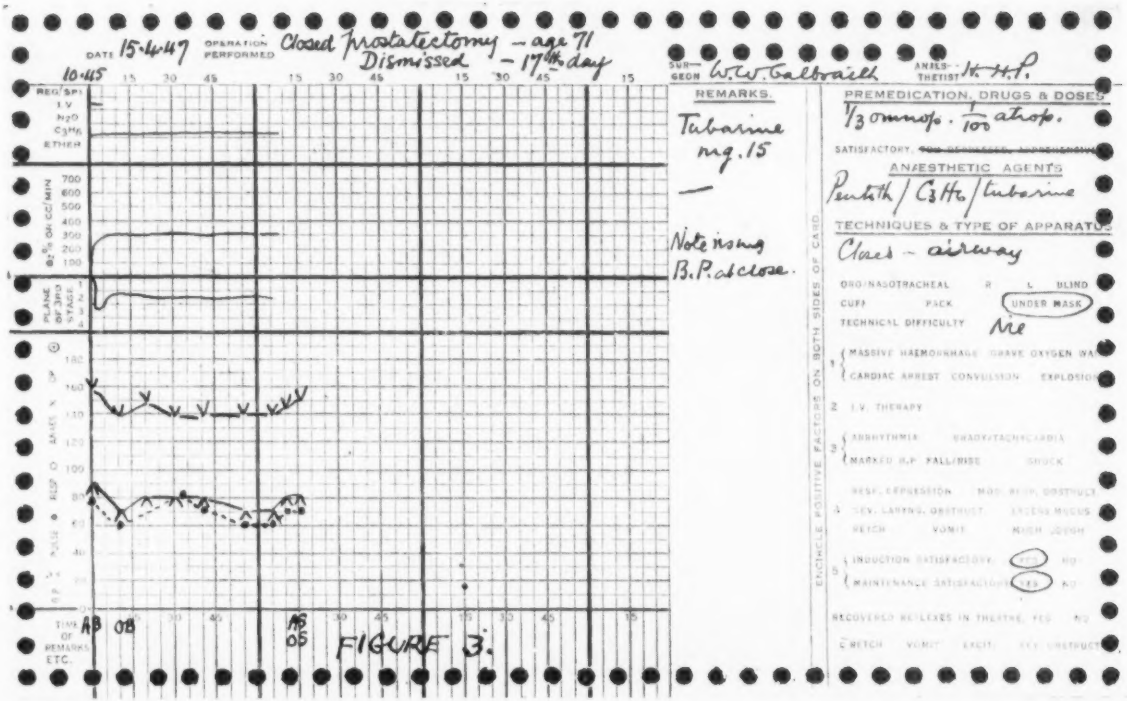
DATE 15.4.47
OPERATION PERFORMED Closed prostatectomy – age 71
Dismissed – 17th day
SURGEON W.L.W. Galbraith
ANES. THETIST H.H.P.
10.45
REMARKS.
Tubarine
mg. 15
Note rising
B.P. at close.
PREMEDICATION, DRUGS & DOSES
1/3 omnop. 1/100 atrop.
SATISFACTORY
ANAESTHETIC AGENTS
Penthth / C3H6 / tubarine
TECHNIQUES & TYPE OF APPARATUS
Closed – airway
ORO/NASOTRACHEAL R L BLIND
CUFF PACK UNDER MASK
TECHNICAL DIFFICULTY Nil
MASSIVE HAEMORRHAGE GRAVE OXYGEN WANT
CARDIAC ARREST CONVULSION EXPLOSION
I.V. THERAPY
ARRHYTHMIA BRADYTACHYCARDIA
MARKED B.P. FALL/RISE SHOCK
RESP. DEPRESSION MOD. RISE OBSTRUCT
LAR. LARYNG. OBSTRUCT EXCESS MUCUS
RETCH VOMIT COUGH
INDUCTION SATISFACTORY YES NO
MAINTENANCE SATISFACTORY YES NO
RECOVERED REFLEXES IN THEATRE YES NO
RETCH VOMIT EXCIT. EXC. OBSTRUCT
REQ'SPT
I.V.
N2O
C3H6
ETHER
O2 % OR CC/MIN
700
600
500
400
300
200
100
PLANE OF 3RD STAGE
I
II
III
PULSE
RESP
B.P.
TIME OF REMARKS ETC.
AB OB
AS OS
ENCIRCLE POSITIVE FACTORS ON BOTH SIDES OF CARD

FIGURE 3.

H.H.P.

H.H.P.

the relaxation being secured by the use of curare. Figure 2 shows the anæsthetic chart of an elderly lady of 70 years who had both ureters transplanted as well as a very radical cystectomy. The complete operation was performed in two stages, each of which took about two hours, much time being consumed in dealing with the many adhesions which remained after previous abdominal operations. The chart shows how well she endured the first operation, from which she made an excellent recovery. A similar technique was employed on the second occasion—one month later—with equal success except that some fall in blood-pressure accompanied the cystectomy at which there was a considerable loss of blood. The fall was arrested by the early start of a blood transfusion. It seems reasonable to suggest that no other anæsthetic technique would have suited this elderly patient any better.

While on the subject of transfusion, and remembering how often pre-operative and post-operative intravenous therapy are now in the hands of the anæsthetist, it should be emphasized that operations such as open fulguration of bladder tumours and nephrectomies for such conditions as hypernephroma often entail considerable loss of blood. This in patients who may have been suffering from a persistent hæmaturia can be a serious matter. Consequently all such cases should be typed for a blood transfusion which, thus premeditated and planned, can be speedily instituted should the need arise.

Kidneys and Ureters

Operations on the kidneys and ureters are preferably performed under general anæsthesia, the lateral position with elevation of the bridge or the use of inflatable kidney bags being an uncomfortable one for the conscious patient. When a unilateral type of spinal analgesia or a paravertebral block is used for some special reason, the block in either case should extend to the eighth dorsal segment. In paravertebral block, the nerve roots from D. 8 to L. 3 should be blocked with in addition deep injections on the lateral surfaces of the corre-

sponding vertebral bodies to render handling of the kidney-pedicle painless.

Continuous pentothal with gas and oxygen, pentothal followed by cyclopropane or cyclopropane and minimal ether give a satisfactory choice of general anæsthesia. The operation of nephro-ureterectomy for tuberculous kidney with ureteric involvement is a fairly severe one, and there would appear to be an increased liability to post-operative pulmonary collapse. A careful look-out should be kept and immediate treatment instituted should this complication occur. Finally in connection with operations for kidney tumours an X-ray examination of the chest should never be omitted.

Prostatectomy

The urologist has admitted, publicly as well as privately, that the anæsthetist is an important member of his team, most particularly in the surgical treatment of the prostate gland. Certainly these elderly patients presenting themselves for prostatectomy require every consideration if the best results are to be obtained. There are, broadly speaking, no less than *five* separate operative methods to consider—(1) transurethral resection (which has already been dealt with), (2) the Freyer operation, (3) the Wilson Hey technique, (4) the Millin retropubic extravesical approach, and (5) the method of prostatectomy with closure of the bladder as devised by Harris. To these we may have to add (6) vesico-capsular prostatectomy, described by Mr. Ogier Ward (1948)[4]. There is no evidence so far that this latter method calls for any special anæsthetic technique.

Some of the patients presenting themselves for prostatectomy are in good general condition and are ready for operation without much preliminary treatment. Others are the victims of an unrecognized overflow from a distended bladder and their renal mechanism has been thrown out of gear. Uræmia has developed or is impending and most clinics therefore favour a period of suitable treatment before operation. Such

preliminary preparation may include, as already indicated, a temporary suprapubic decompression when this cannot be accomplished by means of an indwelling catheter. Local analgesia is usually satisfactory for the establishment of the suprapubic drainage when this is necessary. It is on the patient's first admission or during the above preliminary phase of treatment that the anæsthetist should have the opportunity of visiting and assessing his patient, and of instituting treatment to improve his operative chances.

In the assessment of the candidate for prostatectomy, attention should be paid to his general condition and appearance, and enquiry should be made into his habits and recreations. The elderly man who walks five miles, digs in his garden or enjoys a game of golf is usually in good form, irrespective of what may be heard with a stethoscope. Estimation of blood-pressure should accompany examination of the heart and chest, and a specimen of blood is taken for urea content. When the results of this examination suggest that the patient will be fit for operation in a few days, the time has come to begin the pre-operative build-up. Mild physiotherapy in the form of breathing exercises is begun, and a short course of strychnine is prescribed. It is given as a mixture containing m. 5 of liquor strychninæ thrice daily, for a few days before the operation, and 1/30th gr. strychnine is added to the premedication one hour before going to the theatre. Following operation, gr. 1/60th strychnine is given hypodermically every four hours until the next day, when the oral mixture is resumed for a further three or four days. The benefits which follow the use of strychnine arise from the effects of this drug on muscle tone (Henderson).[5] This improved tone results in support to the circulation and in increased production of carbon dioxide, which means a better respiratory excursion with improved return of blood through the large veins to the right heart. From here an increased pulmonary circulation is followed by improvement in the intake and output of the left heart to the systemic circulation. A higher muscle tone in the lower

limbs does much to obviate phlebothrombosis, a complication which has barely troubled our prostatectomy patients.[6] So-called "delayed shock," occurring four to six hours after prostatectomy is a complication which proves troublesome in some urological units, but this feature is rare in my experience, and whatever part a careful anæsthesia and operative technique may play, it is to the use of strychnine that much of the credit should go. It is well recognized that post-operative shock is accompanied by a conspicuous decrease in muscle tone, whether general or spinal anæsthesia has been employed (Gellhorn).[7] It is not unreasonable to take the view that the converse may be equally true—that maintenance of muscle tone will prevent the post-operative or "delayed shock".

Acknowledging the value of the pre-operative treatment described, and having made the necessary clinical examination of the patient, the final assessment of his condition is based upon (1) the state of his cardio-vascular system, (2) his psychological make-up, and (3) that intangible factor called the experience of the anæsthetist in sizing up his man. The behaviour of the renal system is indicated by the blood-urea examination, and after consultation with anæsthetist and physician, the urologist determines the operation to be performed.

It may be that the patient in poor condition cannot be sufficiently improved to warrant the performance of anything but a rapid enucleation of the gland. Such a technique, after the type of *the Freyer operation,* exposes the patient to a minimal operative procedure, short of condemning him to a permanent supra-pubic tube. The operation may be performed under spinal analgesia or under any straightforward general anæsthetic such as gas/oxygen/ether or cyclopropane and ether, experience favouring general anæsthesia as there is less danger of upsetting the cardio-vascular mechanism, an upset which may follow a severe fall in blood-pressure consequent upon spinal analgesia.

The *Wilson-Hey method* leaves no time for pre-operative

development, and spinal analgesia is the anæsthetic of choice with a certain well-defined proviso.[8] It is that the anæsthetic effects are limited to a level which does not permit of a fall in blood-pressure of more than 30 mm. Hg at the close of the operation. A serious fall of blood-pressure in old men is followed by cardio-vascular and nervous disturbances, such as thrombosis, which may occur immediately or subsequent to the operation. Wilson Hey states that too much emphasis cannot be laid upon this blood-pressure question. He favours the use of 1.4 c.c. heavy Nupercaine injected at the third lumbar interspace and the patient is laid flat. Whenever light anæsthesia reaches a point mid-way between the symphysis and the umbilicus, the patient is tilted with the feet downwards so that anæsthesia never reaches the umbilicus. At the same time an intramuscular injection of methedrine (1. c.c.) or its equivalent is given. If the initial blood-pressure is unduly low, e.g. 85 mm. Hg, the surgeon makes use of a local anæsthetic for the suprapubic incision when full anæsthesia has reached no higher than the groins. In such cases there should be no descent of the blood-pressure at all, indeed the pressure ought rather to be higher at the close of the operation than at the beginning.

For the *retropubic operation,* Magill, writing in Millin's book "Retropubic Urinary Surgery" expresses a preference for intermittent pentothal sodium along with gas and oxygen.[9] The amount of pentothal is limited to 1 gm. The main advantage claimed for this method is the early co-operation of the patient in breathing deeply for the avoidance of post-operative pulmonary complications. Although advocating spinal analgesia as a useful alternative if expert general anæsthesia is not available, Magill cites the tendency of spinal analgesia to cause post-anæsthetic detrusor weakness with the absence of the desirable "vis a tergo" which keeps the bladder empty and minimizes the tendency to clot formation. Learmonth in the article previously quoted[2] reminds us that the parasympathetic is in control of micturition.

Before leaving the choice of anæsthesia for the retropubic operation, attention must be particularly drawn to a short note by Rowbotham[10] in the journal "Anæsthesia" on "Hæmostasis in Prostatectomy". Vaso-constriction and contraction of the prostate bed are obtained by paralysing the parasympathetic supply to this region, thus allowing unrestricted action of the sympathetic. This is achieved by the use of spinal analgesia which affects only the sacral segments, including of course the parasympathetic fibres connected with them.

Forrester[11] has skilfully adapted this observation to extend the usual "low spinal" to include the lumbar segments up to the third, leaving the sympathetic origins in the upper two lumbar segments undisturbed, and yet obtaining *sensory* anæsthesia of the skin and subcutaneous tissues in the suprapubic region. The exact technique is very important as the limitation of the upward spread is the secret of success. He makes use of the fact that the nerve supply to the adductor muscles of the thighs arises mainly from L. 3—the patient's legs are raised and the knees placed together after the spinal drug has been injected. Whenever motor paralysis involves L. 3, the knees begin to separate. The patient is then tilted into the reverse Trendelenburg position, and though sensory paralysis is often adequate, a small amount of pentothal, sufficient to produce sleep, is introduced into the drip which is set up routinely in these cases. It is claimed for the method that it produces hæmostasis without an accompanying fall in blood-pressure.

Finally, there is the choice of anæsthesia for *closed prostatectomy*. Following careful pre-operative measures as already indicated, premedication is limited to omnopon gr. ⅓ and atropine gr. 1/100th. Some younger patients receive scopolamine gr. 1/150th instead of atropine, but scopolamine is unsuitable for elderly patients generally. It may be said at once that general anæsthesia has been consistently employed, as it is easier to ensure maintenance of blood-pressure than under spinal analgesia, and in addition the blocking off numer-

ous afferent and efferent impulses interferes with the maintenance of muscle tone whose importance has already been discussed.

There are certain criteria which govern the choice of a general anæsthetic for the elderly subjects undergoing this operation. These include—(1) induction should be pleasant, rapid and smooth, avoiding cardio-vascular strain; (2) maintenance should be reasonably free from toxicity, especially as far as kidney function is concerned, and the agent should permit of flexibility in the achievement of the various anæsthetic levels required; (3) recovery should be, for the same reason, as smooth as induction, reasonably rapid and free from sequelæ as far as possible. Too rapid a recovery is apt to produce restlessness and efforts to get out of bed—presumably the indwelling catheter induces a desire to empty the bladder in the confused period of recovery, (4) the patient's blood-pressure should be fully maintained—(*a*) for the surgeon's benefit so that he may see the bleeding at its most active and so control it by his stitching, and (*b*) for the patient's benefit —for the reasons already emphasized earlier, viz. disturbances of cardio-vascular and nervous systems.

To meet these criteria, a minimal pentothal induction (often no more than 0.2–0.3 gm.) is followed by cyclopropane. To this is added a small amount of ether; recently, curare in moderate dosage has been used on many occasions instead of adding ether. These additions to the cyclopropane usually result in a peaceful awakening on return to bed. Robbins[12] has also emphasized the importance of the barbiturates in reducing the cardiac arrhythmias attributed to cyclopropane—a reduction enhanced by the addition of a small quantity of ether. The above combination has resulted in the almost total elimination of these potentially serious irregularities. Much is gained by sending the patient away from theatre with the anæsthetic eliminated to the point of re-appearance of muscle tone, e.g. his abdominal muscles should no longer be relaxed, and his jaw should be firmly elevated by the tone in his own

TABLE I

Age	51–60	61–70	71–80	81–90		
	22	85	51	7		– 165
Anæsthetic	Contin. N_2O/O_2 + Ether	Closed Ether	C_3H_6	C_3H_6 + Ether	Spinal + C_3H_6	
	13	73	13	65	1	– 165
Sickness	Nil	i or ii	Mild	Moderate		
	104	44	12	5		– 165
Chest Complics.	Nil	Transient cough + spit	Pulm. Emb.	Post-op. collapse		Bronchitis
	153	9 (3 preop.)	2 (1 fibrill.)	NONE		1 – 165

Mortality = 3.6%. Tubarine cases not included.

jaw muscles. Ordinary air should gradually replace the anæsthetic mixture in the circuit, as the presence of atmospheric air in the alveoli and bronchiolar and bronchial tree is a good defence against a patchy form of atelectasis which may grow to a larger collapse of the lung. It is noteworthy that Magill emphasizes the importance of adequate breathing in the avoidance of pulmonary complications.[9] Sequelæ after this method of anæsthesia are infrequent and the patient is commonly found reading his paper on the morning following his prostatectomy. Tracings of blood-pressure recorded during operation show that the criteria demanded in this direction are fully met and a typical tracing is reproduced in Fig. 3. A statistical review of 165 cases operated upon under various anæsthetics brings evidence of reasonable results. Many of the operations of earlier date were done under gas/oxygen/ether or closed ether, and the inclusion of these does not seem to prejudice the statistics as presented in Table I, but clinically the patients are in better shape after the more modern techniques. Attention is specially directed to the complete absence of clinically recognizable post-operative pulmonary collapse, for which some credit would appear to be due to strychnine.

The figures presented in Table II are taken from the recent Presidential Address by Mr. W. W. Galbraith to the Urological Section of the Royal Society of Medicine.[13] It is with Mr. Galbraith that my experience in anæsthesia for Urological Surgery has been gained, and I would like to conclude by paying this tribute to him for his encouragement and consideration, and for his very early recognition of the importance of co-operation between surgeon, physician and anæsthetist, especially in prostatic surgery.

TABLE II

Type of patient	Number	Died	Mortality percentage
Private	188	8	4.2
Hospital	130	4	3
Total	318	12	3.7

References

1. Riddoch, G. *J. Physiol (Proc. Physiol. Soc.)*, 1921, liv, p. 134.
2. Learmonth, J. R. *Brain*, 1931, liv, p. 147 et seq.
3. Quain. *Quain's Anatomy*, iii, 2, 350–351.
4. Ogier Ward. *Lancet*, 1948, March 27, p. 472.
5. Yandell Henderson. "Adventures in Respiration". The Control of Tonic Elasticity, pp. 199–201.
6. Saklad, Dwyer et al. *Anesthesiology*, May 1947, viii, 3, p. 284.
7. Gellhorn, E. "Autonomic Regulations" (Interscience, Publishers, New York, 1943), p. 268.
8. Wilson Hey. Personal communication to Mr. Galbraith.
9. Magill, I. W. Millin, "Retropubic Urinary Surgery", Chap. xxii.
10. Rowbotham, S. "Anæsthesia", ii, 2, p. 70.
11. Forrester, A. C. *Brit. Journal of Urology*, 1947, xix, p. 176.
12. Robbins, B. H. "Cyclopropane Anæsthesia", 1940. Baltimore.
13. Galbraith, W. W. *Proc. Roy. Soc. Med.*, 1948, xli, 2, p. 73.

DEVICE FOR THE DETERMINATION OF ADEQUATE TIDAL VOLUME UNDER ANÆSTHESIA

By R. P. Harbord, M.D., D.A.

DURING anæsthesia with curare it is not always a simple matter to be sure of an adequate tidal volume because this is judged either by respiratory movements, which vary with the individual, or by the excursions of the reservoir bag. Bags are not all the same size; moreover, spherical alterations are difficult to assess and the visible excursions vary according to the quantity of gas contained.

When respiratory movements are diminished it would be fallacious to judge efficiency of breathing on facial colour changes, because cyanosis may not appear if the subject is breathing an excess of oxygen. In such circumstances carbon-dioxide may accumulate. Theoretically, when the tidal volume falls below about 500 c.c. respiration ought to be aided.

R.P.H.

The device to be described has been designed to show the tidal volume with Water's "to and fro" method of carbon dioxide absorption. It consists of a three-way tap with a detector bag of 600 c.c. capacity and is attached between the soda-lime canister and the rebreathing bag.

When it is suspected that the tidal volume is reduced the tap is turned so that respirations pass only to the detector bag, and the efficiency or otherwise of respiratory movements will be at once apparent. With a little practice the volume of a single expiration can be rapidly determined and the tap switched back in time for at least the end of inspiration to be taken from the rebreathing bag.

The detector bag should be used when the breathing is considered diminished; since an inspiration of over 600 c.c. will suck the walls together it is obvious that the device should not be brought into action with deep breathing. The half-way position of the tap may be used to circumvent this before actually making the test.

The apparatus has been made for me by Messrs. Cyprane Ltd., Oxenhope, Keighley, Yorkshire, at the instigation of Messrs. Chas. F. Thackray Ltd., of Park Street, Leeds 1, from whom it may be obtained. (The block can also be obtained from Messrs. Thackray.)

CORRESPONDENCE

Sir,—I thought that the note below of a rather unusual post-operative death might be of interest. The patient died on the sixth post-operative day from bilateral cortical nephritis:

Mrs. E.L. aet: 42. Housewife. The patient was admitted with a tentative diagnosis of a stomal ulcer of a previous gastroenterostomy. History and investigation confirmed the diagnosis. Her hæmoglobin on admission (D-day−10) was

70 per cent and R.B.C.s were 3.6 million. Blood group was A2. Nothing in the history suggested previous renal disease. The urine was clear. On D–1 one pint of blood was given and there was no evidence of incompatability. Her hæmoglobin before operation was stated to be 85 per cent.

D-day:

Premedication: "Omnopon" gr. 1/3—Hyoscine gr. 1/150.

Anæsthetic: Curare 5 mgm. test dose—"Pentothal-Na" 0.5 gm. The patient was easily intubated under direct vision and anæsthesia was maintained mainly with nitrous oxide but with a little cyclopropane from time to time as required, while relaxation was attained by further curare as detailed below. The anæsthesia was uneventful with no cyanosis and no hypo- nor hyper-tension.

Operation

The gastroenterostomy was obliterated and a gastrectomy performed. The operation was uneventful with no trauma or hæmorrhage.

The patient was visited in the evening and found to be well.

Extract from the anæsthetic record:

Time	9.30	09.40	09.50	10.00	10.10	10.20	10.30	10.40	10.50	11.00
Pulse		94	82	84	66	66	78	80	92	96
Resp.		12	16	12	0	8	10	12	16	17
BP S/D		125/75	105/70	100/70	100/70	100/70	100/70	112/80	112/84	100/80
Remarks	1	2 3	4				5 6	7		8

Time	11.10	11.20	11.30	11.40	11.50	12.00	12.10	12.20	12.30
Pulse	62	68	60	80	92	96	94	90	84
Resp.	14	14	18	16	16	18	16	21	15
BP S/D	94/80	104/84	118/80	130/90	125/80	150/95	150/100	135/90	120/85
Remarks	9		10					12	13

REMARKS

1. Curare 5 mgm. Induction.
2. Operation. Curare 5 mgm.
3–7. "Undoing" gastroenterostomy.
4–5. Reconstruction of small intestine.
6. Curare 10 mgm. (10.30).
7. Began gastrectomy.
8. Blood (11.05) started. Curare 5 mgm.
9. Blood faster.
10. Curare 7 mgm. (11.30).
11. Blood, 2nd bottle.
12. Closure (12.20).
13. Finish (12.37).

Progress Notes

D-day + 1. Drip maintained with saline with one pint blood.

D + 2. Patient well. Hb 85%; P 132; T 99. Drip maintained (saline). Fourth pint blood given. No sign of reaction.

D + 3. Patient well—doubtful jaundice—T normal.

D + 4. Slight cough. O/E: Basal creps. P 124; R 20; T 99.

D + 5. Cough improved; Hb 85%; T.P.R. normal.

D + 6. Late on this day there was complete suppression of urine—Catheterized with almost nil result. Blood urea 200 +. Available urine: R.B.C.s +; Album. +; Chlorides −. Given IV Sod. sulphate, but died five hours later (T 101).

Post-mortem examination showed that there was a bilateral degeneration of the renal cortex which was represented by a pale strip. There was a fine trace of normal tissue subscapularly.

Comment

Munro-Kerr[1] mentions this condition as a rare sequel to toxæmic pregnancies, or, possibly, following serious accidental hæmorrhage. Fishberg[2] also associates the condition with pregnancy toxæmia. It is also known in acute bacterial lesions such as pulmonary tuberculosis. There seems to be little mention in anæsthetic or surgical literature of this condition occurring as an operative complication. All the blood for Mrs. E.L. was of the same group as herself and was cross matched. There was at no time a sustained hypotension. No "sulpha-" drug was administered, and, apart from the anæsthetic drugs with morphine sedation, there were no drugs used. The writer's feeling is that morphia, "Pentothal", and cyclopropane are blameless. No hint in the literature that has been seen would seem to indicate d-tubocurarine chloride was causative, although the case bears a similarity to those of Hewer and Woolmer[3] and of Pugh and Enderby[4] who used "myanesin", while it also bears a resemblance to the Maegraith *et al.*[5] description of renal anoxia (but without the prolonged hypotension).

It would, Sir, be most interesting to hear if other anæsthetists

have met this rare complication in similar circumstances of anæsthesia, especially in sequel to curare.

Yours faithfully,

H. Q. O. WHEELER

Assistant, Dept. of Anæsthetics, St. Andrews University; Anæsthetist, Royal Infirmary, Perth.

REFERENCES

1. Munro-Kerr, J. M. "Combined Textbook of Obstetrics", Ch. 11, p. 237.
2. Fishberg, A. M. "Hypertension and Nephritis", Ch. 25, p. 745.
3. Hewer, T. F., and Woolmer, R. F. *Lancet*, 1947, Dec. 20th, p. 909.
4. Pugh, J. L., and Enderby, G. E. H. *Lancet*, 1947, Sept. 13th, p. 387.
5. Maegraith, B. G., Harvard, R. E., Parsons, D. S. *Lancet*, 1945, ii, 293.

I am indebted to Mr. C. Charleson for the use of clinical notes of this case.

REVIEWS

Neurological Complications after Spinal Anæsthesia and results from 2493 follow-up cases. GUNNAR THORSEN. pp. 272, charts and photographs. Price 15 *kroner*. A B Nordiska Bokhandeln, Stockholm.

The book is prefaced by the statement of MacDonald Critchley "if any one point emerges . . . it will be the fact that a very significant number of nervous sequelæ are completely overlooked". The contents of the volume amply justify this remark. The author says that before embarking on his investigation he believed that the complications of spinal anæsthesia were rare. He has come to the opposite conclusion. The mechanism of origin remains, he says, in

most instances unsolved. His hypotheses will, he hopes, stimulate research in other quarters. The material is mostly from the Central Hospital of Orebro where 1200 to 1500 injections are made annually. A questionnaire during three successive years was addressed to all patients who had undergone injections; 74.7 per cent of answers were received. Percaine and novocaine were employed. Disturbance after spinal anæsthesia can be divided into two groups, one in the cerebral region; the other in spinal cord, roots, cauda or surrounding membranes, epidural cavities, vertebral column and soft-tissue parts. Meningitis represents a link between these. The headache so common after spinal injection is attributed to leakage.

Introduction a l'etude de L'Anæsthesie. L. DAUTREBANDE, Professor à l'Université de Liége, E. PHILPOT and M. J. DALLEMAGUE. pp. 1235. 288 illustrations. Masson & Cie, Paris.

This great volume is of course much more than an introduction. It is a complete account of the chemistry and physiology of anæsthesia and a full if rather less comprehensive description of the clinical application of anæsthetics. It finishes with an excellent bibliography.

Paravertebral Block. FELIX MANDL, M.D., F.I.C.S. pp. 330 with charts. Price 32*s*. Wm. Heinemann Medical Books Ltd., London.

Paravertebral injection aims at producing anæsthesia in the neighbourhood of the sympathetic cord, the sympathetic ganglia or the rami communicantes of one or several segments. The book starts with a description of the relevant anatomy, and the technique of injection. All the various methods aim at establishing contact with the sympathetic at the anterior surface of the vertebræ. Paravertebral block is of differential diagnostic significance in abdominal disease. It is also used

to determine the prognosis of sympathetic operations and therapeutically in some abdominal affections. Also in some serious disorders of the extremities it is used to improve the blood supply and to bring relief from pain.

The Care of the Teeth: Pre-natal and in Infancy. E. HERBERT, H. RUSSELL. pp. 48. Price 2*s*. John Sherratt & Son, Altrincham.

This is a careful study of a matter to which, generally speaking, too little attention is paid. The author gives sound advice both for mother and child, and we believe the little book should be studied by general practitioners, for whom its contents have much value.

The Conquest of Brain Mysteries. GEORGE BANKOFF, M.D., F.R.C.S. pp. 174 illustrated. Price 6*s*. Macdonald & Co., Ltd.

This book could be read with advantage by the layman, but it is not without interest for the trained medical man. The author deals in a lucid and plausible manner with the many difficult problems presented to any writer who seeks to explain and illustrate the nature and functions of the human mind. He gives a good and comprehensive account of psycho-analysis and of its principal exponents and, claiming for the book no scientific status, believes that it may prove "helpful not only in knowledge but also useful entertainment in hours of gloom and despondency". We think he makes a modest and well-justified claim. To one passage, not an important one, we take exception. This is where the author says that difficulty in recalling a name is due more often than not to some unfortunate association with the person concerned. It does not appear from experience that we recall names that have a pleasant association for us any more easily than those which have not.

Endotracheal Anæsthesia. 2nd edition, revised and enlarged. Noel A. Gillespie, Associate Professor of Anæsthesia, University of Wisconsin. University of Wisconsin Press, 811 State Street, Madison, Wisconsin, U.S.A.

Dr. Gillespie's valuable little book has not unnaturally reached its second edition, for it is a most sound, clear, and precise source of information and instruction for any anæsthetist embarking on the practice of endotracheal anæsthesia. In this edition the author acknowledges the help he has received from comments by Gilbert Brown, Nosworthy, Waters, and W. E. Sykes among others. Besides other illustrations there is one coloured plate.

THE EXAMINING BOARD IN ENGLAND

DIPLOMA IN ANÆSTHETICS

Part I: May 21st, 1948. From 9.30 a.m. to 12.30 p.m.

Applied Anatomy and Pathology

Candidates are advised to answer *all* the questions. Candidates are informed that one of the Examiners is present during part of the time allowed for the paper, for consultation in case any question should not appear clear.

1. Describe the relations of the right bronchus.
2. Describe the contents of the ante-cubital fossa. What abnormalities are commonly found in this region?
3. Describe the second division of the 5th cranial nerve and its relations.
4. Discuss briefly the causation of thrombosis. What results follow thrombosis in the femoral vein?

Part I: May 21st, 1948. From 2 to 5 p.m.

APPLIED PHYSIOLOGY AND PHARMACOLOGY

1. Discuss the factors concerned in the regulation of arterial blood pressure.
2. Give an account of the chemical control of breathing.
3. Describe the general arrangement of the autonomic nervous system. Give examples to illustrate the actions of this system on various organs.
4. Give an account of the drugs which may be used as local anæsthetics. What side-effects may they produce?

Part II

1. Discuss the statement that advances in surgery during the last twenty years have been dependent upon advances in anæsthesia.
2. Describe the sacral canal and its contents. Mention the limitations and dangers of caudal analgesia.
3. Give in detail the anæsthetic technique which you would employ for the instillation of lipiodol into the bronchial tree for X-ray examination of a child aged 7 years suffering from bronchiectasis.
4. How would you sterilize:
   (*a*) The facepiece of an anæsthetic apparatus used on a patient suffering from active phthisis?
   (*b*) A 20 c.cm. Record syringe used for intra-thecal injection?
   (*c*) A 10 c.cm. Record syringe used for intravenous injection?
   (*d*) A 1:250,000 solution of adrenaline hydrochloride in normal saline?
5. Describe the preparation and physical properties of ethyl chloride. What are its dangers when used as a general anæsthetic?

THE FACULTY OF ANÆSTHETICS

The Royal College of Surgeons, by instituting a Faculty of Anæsthetics, has much enhanced the academical status of the anæsthetist. We give herewith the names of the officers of the Faculty.

Board of Faculty. June 1948

Dr. A. D. Marston, Dean (Guy's)
Dr. Bernard Johnson, Vice-Dean (Middlesex)
Dr. I. W. Magill, C.V.O. (Westminster)
Dr. E. S. Rowbotham (Royal Free)
Dr. C. Langton Hewer (Bart's)
Professor R. R. Macintosh (Oxford)
Dr. R. E. Pleasance (Sheffield)
Dr. W. Alexander Low, M.C. (St. Thomas's)
Dr. Frankis T. Evans (Bart's)
Dr. John Gillies, M.C. (Edinburgh)
Dr. J. H. T. Challis (London)
Dr. George Edwards (St. George's)
Dr. Katharine G. Lloyd-Williams (Royal Free)
Dr. B. L. S. Murtagh (Birmingham)
Dr. A. H. Musgrove (Cardiff)
Dr. H. J. Brennan (Manchester)
Dr. Vernon F. Hall (Middlesex)
Dr. Ronald F. Woolmer (Bristol)
Dr. G. S. W. Organe (Westminster)
Dr. T. C. Gray (Liverpool)
Dr. E. A. Pask, O.B.E. (Newcastle)

The following is the first list of Fellows:

Helen B. Alcock
R. E. Apperly
Philip Ayre
Freda Bannister
R. A. Beaver
J. Blomfield
John Boyd
E. G. Bradbeer
R. J. B. Broad
G. Maxwell Brown
F. F. Cartwright
J. N. Cave
L. T. Clarke
R. J. Clausen
R. W. Cope
H. P. Crampton
A. S. Daly
C. J. Massey Dawkins
I. M. Campbell Dewar
H. W. Featherstone
D. Keir Fisher
R. Blair Gould
C. F. Hadfield
E. M. Handfield-Jones
R. P. Harbord
T. A. B. Harris
J. K. Hasler
B. P. Hill
E. Falkner Hill
M. W. P. Hudson
C. H. M. Hughes
John T. Hunter
Ronald Jarman
E. F. Johnson
W. J. Bennett Jones
Miss A. R. Kerridge
E. Landau
J. A. Lee
A. Goodman Levy
W. S. McConnell
V. O. McCormick
R. Machray
J. Ross Mackenzie
R. E. Mansfield
Z. Mennell
Edith Joan Millar
Arthur Mills
R. J. Minnitt
C. W. Morris
L. H. Morris
H. J. V. Morton
W. W. Mushin
M. D. Nosworthy
G. R. Phillips
H. H. Pinkerton
K. B. Pinson
A. F. Potter
W. B. Primrose
R. J. Probyn-Williams
B. Rait-Smith
H. A. Richards
E. H. Rink
Alison Ritchie
F. W. Roberts
S. Thompson Rowling
J. F. Ryan
E. A. Scott
W. M. Shearer
Sir Francis Shipway
O. L. C. Sibley
H. Sington
G. F. Rawdon Smith
R. L. Soper
C. E. Sykes
V. E. Vessell
F. F. Waddy
Sheina C. H. Watters
H. N. Webber
Humphrey B. Wilson
H. Bruce Wilson
H. Woodfield-Davies